Electrostatic self-assembled 3D graphene oxide-collagen nanocomposite as scaffold for tissue engineering.

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During the past few years, graphene oxide (GO) has been brought into the spotlight of regenerative medicine research due to its remarkable biochemical and physical properties. Indeed, GO has been reported not only as an influential agent in promoting a controlled and enhanced stem cell behavior, but also as a versatile building block for the construction of complex composite tissue engineered scaffolds such as hydrogels [1, 2]. The potential of collagen (Col), which is the most abundant protein in the natural extracellular matrix (ECM), to work as physical crosslinker for GO sheets has not yet been addressed.

In this work, we explored the electrostatic self-assembly of the negatively charged GO sheets and the positively charged Col particles to built a porous scaffold able to offer a suitable and adaptable cellular microenvironment for regenerative medicine approaches (Figure 1a). The structural integrity of each GO-Col scaffold, which was tested after mechanical and swelling tests, was deeply related with two main conditions of the synthesis process: the % w/w of Col relatively to GO and the pH of the medium. The biocompatibility of the selected GO-Col scaffold and its reduced contra-part (rGO-Col) using a Rat Schwann cell line (Fig 2). Both GO-Col and rGO-Col scaffolds guarantee excellent cell-material interactions that can be further potentiated by the introduction of mechanical and electrical stimuli in the system via our patented bioreactor system [5] (Figure 1b and c). Our expectation is that such strategy could be used in the modulation of stem cell response, especially directing the differentiation process into specific cell lineages.

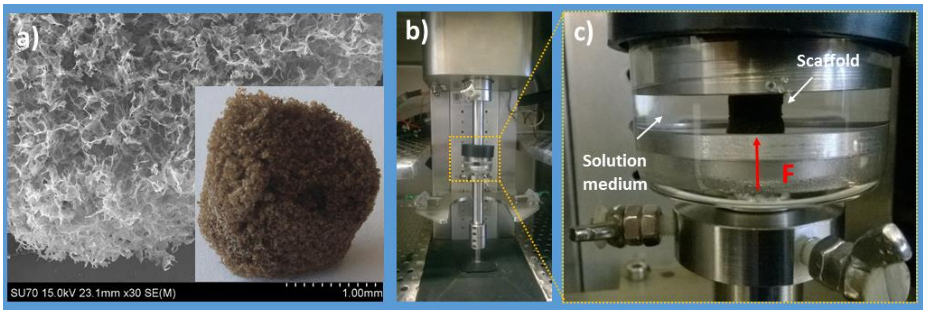

Fig. 1. a) SEM image of GO-Col scaffold and picture (inset); b) and c) Mechanical stimulation of the GO-Col scaffold at the bioreactor apparatus.

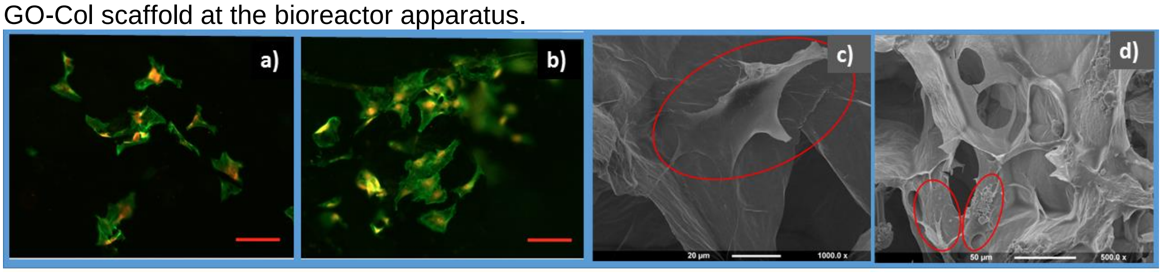

Fig. 2. Micrographs showing Schwann cells seeded on GO-Col (a) and rGO-Col (c) scaffolds. SEM images showing cell-material interactions. a-b) GO-Col scaffolds; c-d) rGO-Col scaffolds. Red circles showing Schwann cells.

References
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